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# Growing buckwheat



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The map on the cover has dots representing Agriculture Canada research establishments.

## ONE HUNDRED YEARS OF PROGRESS

The year 1986 is the centennial of the Research Branch, Agriculture Canada.

On 2 June 1886, *The Experimental Farm Station Act* received Royal Assent. The passage of this legislation marked the creation of the first five experimental farms located at Nappan, Nova Scotia; Ottawa, Ontario; Brandon, Manitoba; Indian Head, Saskatchewan (then called the North-West Territories); and Agassiz, British Columbia. From this beginning has grown the current system of over forty research establishments that stretch from St. John's West, Newfoundland, to Saanichton, British Columbia.

The original experimental farms were established to serve the farming community and assist the Canadian agricultural industry during its early development. Today, the Research Branch continues to search for new technology that will ensure the development and maintenance of a competitive agri-food industry.

Research programs focus on soil management, crop and animal productivity, protection and resource utilization, biotechnology, and food processing and quality.

# Growing buckwheat

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## **Growing buckwheat**

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### **Introduction**

Buckwheat has become an important special crop in Canada. Plantings have averaged about 46,377 ha each year during the past decade. Manitoba produces the majority of buckwheat in Canada with a 10-year average of 37,635 ha.

Although buckwheat is not a true cereal, it is usually classed with the cereals because the crop and its grain are handled in the same way as a cereal.

The buckwheat described in this publication is common buckwheat, Fagopyrum esculentum Moench. A related species, tartary buckwheat, F. tataricum (L.) L.J. Gaertn., is cultivated in Eastern Canada but is a noxious weed in Western Canada. Wild buckwheat, Polygonum convolvulus L., a common weed, is more distantly related. These related species do not cross with common buckwheat.

Buckwheat is grown mainly to produce seed for human consumption. It is also used as a green manure crop, as a smother crop to crowd out weeds, and as a source of buckwheat honey. About two-thirds of the Canadian buckwheat crop is exported, with Japan being the largest customer. The Japanese grind most of the buckwheat into flour for making noodles and they use the hulls from the seed for stuffing pillows.

### **The buckwheat plant**

The buckwheat plant is a broad-leaved, erect annual with a single main stem and several branches. It has a shallow taproot system with several branched lateral roots. The root system is less extensive than those of the true cereal grain plants. The limited root system and large leaf surface combine to make the plant susceptible to wilting during periods of moisture stress.

The stem is usually smooth, grooved, succulent, and hollow. It varies from green to red and turns brown as it approaches maturity. The dark green leaves are heart shaped.

Buckwheat has an indeterminate flowering habit. Dense clusters of showy flowers bloom at the ends of branches or on short pedicels arising from the axils of the leaves. The flowers are usually white, but pink ones occasionally occur. The flowers have five petal-like sepals and occur in two main types. The pin type has long styles and short stamens, and the thrum type has short styles and long stamens. The plants usually do not set seed with their own pollen. Consequently, pollination must occur between plants of different flower types and is usually done by insects such as bees.

Botanically the seed is called an achene. Its hull is triangular and varies from brown through gray to black in color. The groat, which is the tissue inside the hull, is covered by a thin layer of material. This layer is green when the seed is first harvested and turns reddish brown as the seed ages.

#### Adaptation

Buckwheat grows well during warm weather, but it is sensitive to high temperatures and hot, dry winds, especially when moisture is scarce. These conditions during flowering can cause flower blasting, which reduces seed set and yield. Buckwheat is susceptible to frost and can be severely damaged by late spring or early fall frost. Therefore, seeding should be delayed until the danger of spring frost is past. Because of its short growing season, only 10-12 weeks, buckwheat is sometimes used as a catch crop in an emergency. It can be grown when wet weather or a late spring delays the seeding of cereal crops or when another crop has failed because of severe weed infestation or poor stands. Buckwheat must be seeded early enough, however, so that the seeds are well formed and nearly mature before fall frost kills the plant.

Although buckwheat is best adapted to well-drained sand or silt loam soils, it grows well under a wide range of soil conditions. It is often grown on heavier soils but should not be seeded on poorly drained, saturated soils. When buckwheat is subjected to high winds or heavy rains or is grown on very fertile soils, it also tends to lodge.

#### Place in the rotation

When you select a field for buckwheat, avoid fields previously seeded with wheat, oats, or barley because cereal grains from volunteer plants are difficult to separate from buckwheat. Buckwheat should follow these three cereals only if the land can be tilled in the fall and again in the spring to germinate volunteer seeds and eliminate resulting seedlings. Never seed buckwheat on rapeseed, mustard, or sunflower stubble because volunteers from these crops are difficult to control.

Carefully select a suitable crop to follow buckwheat in the rotation. Because buckwheat seeds shatter easily, volunteer growth often occurs in the field the next year. To control volunteer growth of buckwheat in succeeding crops, apply herbicides when the buckwheat is in the seedling stage. The crop following buckwheat must be resistant to the specific herbicide applied. Consult your agricultural representative for the latest herbicide recommendations for your area and choose your next crop accordingly.

As a precaution, wait at least 2 years between buckwheat crops in a rotation; although at present disease is not a problem in buckwheat, this practice reduces the risk of disease organisms increasing. It also minimizes the mixing of buckwheat cultivars that occurs when volunteers from a previous crop are allowed to grow with the new crop.

## Cultivars

The cultivars Mancan, Manor, and Tokyo are licensed for production in Canada. All three are classed as midseason types. Although a limited amount of nonlicensed buckwheat is also produced, growers should use Pedigreed seed to ensure top quality and high production.

Mancan buckwheat was developed at the Research Station, Morden, Man. It has large seeds, thick stems, and large leaves. The flowers are white, although some pink ones do occur. It has dark brown to black seeds, some of which have wings that are paperlike extensions of the hull.

Manor buckwheat was also developed at the Research Station, Morden, Man. It has large seeds, thick stems, and large leaves, similar to Mancan. The flowers are white and the seeds are dark brown to black. Manor has a more concentrated flowering period than does Mancan.

Tokyo is a combination of two lines developed from a Japanese introduction by the Research Station, Ottawa, Ont. Its leaves, stems, and seeds are smaller than Mancan or Manor and the seed is dark brown. It is a vigorous-growing cultivar.

A quantity of nonlicensed buckwheat is also produced each year. It is usually a mixture of Japanese and Silverhull types that produces small seed and highly variable plant and seed characteristics.

Mancan and Manor are preferred in the Japanese market because of their large seeds and high percentage of groat. Canadian buckwheat breeders are presently developing earlier, larger seeded cultivars with reduced height for improved lodging resistance. These are expected to replace the smaller seeded types that are less desirable in the export market.

## Seedbed preparation

Prepare the seedbed for effective control of weeds, conservation of moisture, and provision of firm soil near the surface. Although shallow tillage in early spring may not be necessary on light-textured soils, it promotes early germination of weed seeds on heavier soils. A second tillage just before seeding kills these weeds. To minimize moisture loss, maintain a firm seedbed, and reduce chances of bringing new weed seeds to the surface, keep tillage shallow. Harrowing should then leave the field ready for seeding with a grain drill. Alternately, seeding with a discer allows you to combine the three final operations into one.

## Date, rate, and depth of seeding

It is important to remember that buckwheat is susceptible to frost in late spring and early fall. Tests at the Morden Research Station have shown that yields are highest when the crop is seeded soon after the risk of frost has passed but they decline sharply if seeding is delayed. For example, yields from buckwheat seeded at the beginning of June were as much as double

those from seedings made at the end of June. When the crop is used as an alternate to summerfallow, seedings as late as early July sometimes give satisfactory returns. However, because buckwheat requires 10-12 weeks to produce an acceptable crop, late seeding is risky in areas where frosts are common in early fall.

A seeding rate of 40-55 kg/ha is recommended. The higher rates are suggested for fields where weeds may be a problem. A high plant population helps the crop to compete with weeds. Buckwheat plants branch extensively and are often capable of compensating for thin stands. Therefore, if poor emergence occurs, delay turning the crop down until you are sure the plants will not produce an adequate canopy.

Seed 4-6 cm deep. Although shallow seeding is desirable for rapid emergence, it is important to place the seed in moist soil. Use a conventional grain drill or a discer for seeding. Seed treatment is not necessary in the prairies.

### **Fertilizers**

When soil fertility is low, buckwheat responds well to fertilizer. A buckwheat crop that yields 1600 kg/ha removes 47 kg nitrogen, 22 kg phosphorus ( $P_2O_5$ ), and 40 kg potassium ( $K_2O$ ) from the soil for each hectare planted. Have your soil tested and fertilize accordingly. Too much nitrogen encourages vegetative growth and promotes lodging. In most soils, the application of phosphorus is likely to produce a consistent increase in yield. For best results, sideband the phosphorus 2.5 cm to the side and 2.5 cm below the seed. If fertilizer is applied with the seed, do not exceed 7 kg/ha for nitrogen and 20 kg/ha for phosphorus ( $P_2O_5$ ) to avoid injury to the seedlings. Higher amounts of nitrogen and phosphorus and all potassium should be placed away from the seed.

For current information on fertilizer recommendations in each province, refer to the publications that are available on request from either the provincial or federal departments of agriculture.

### **Weed control**

Most weeds are controlled by carefully preparing the seedbed. In good stands of buckwheat the seedlings compete strongly and smother weeds. In thin stands, further controls may be needed if a severe weed problem is anticipated. For the latest recommendations in weed control, consult your local agricultural representative.

### **Pollination**

Buckwheat is naturally cross-pollinated, usually by insects. Honey bees and leafcutter bees are effective pollinators. Besides increasing seed set and seed yield, honey bees return an added value in the honey they produce. Buckwheat honey is darker than No. 1 White Honey and has a distinctive flavor.

Flowering begins 5 or 6 weeks after the seed is sown and continues for at least a month, often until frost. An arrangement with an apiarist can help maximize pollination of the crop to your mutual benefit. If you advise the apiarist where you intend to seed buckwheat, colonies can be placed to maximize buckwheat yield and honey production and to avoid undesirable mixtures of honey from different crops.

### **Insects and diseases**

Problems with insects and diseases are not common. Cutworms and aphids can cause damage, and occasionally control becomes necessary. Aster yellows sometimes occurs, but it seldom causes extensive losses. Recently, downy mildew, which occurs in humid weather, has been identified as causing foliar lesions that may reduce yield. If a severe insect or disease problem develops, consult your local agricultural representative for the most effective control.

### **Harvesting and threshing**

Buckwheat is usually swathed, then harvested with a combine after the plants and seeds have dried. Because buckwheat has an indeterminate growth habit, flowers, green seed, and mature seed are present on the plant at the same time. Often much of the total yield is produced in the cooler weather just before frost, and early swathing can reduce yield. If plants are flowering profusely and there is a heavy set of green seeds developing, it is best to delay swathing. Generally, if flowering is almost finished, swathing should be done when 75% of the seeds have turned brown. If there is severe frost damage, swath the crop promptly. Seeds shatter easily once the plants dry, and lodging can occur soon after severe frost. However, if the frost was light, there may be many green seeds that will still develop and swathing may be delayed until the usual time. Swathing in the early morning when dew is present or in damp weather helps keep losses caused by shattered seed to a minimum. The reel speed should correspond to ground speed to reduce shattering. Careful handling is very important because shattering losses of up to 22% have been recorded on experimental plots.

Combine the crop when the seed in the swath contains less than 16% moisture. In order to reduce shattering, reduce the pickup speed to match the ground speed. A draper type of pickup causes less shattering than a drum type. To minimize seed breakage, reduce the cylinder speed initially to about 600-800 revolutions per minute and set the concaves to 13-16 mm in the front and 9 mm in the rear. If breakage is excessive, further reduce the cylinder speed or increase the concave clearance. Set the upper sieve initially at 16 mm and the lower sieve at 8 mm. The lower sieve can then be opened gradually to the setting that does not allow excessive foreign material to pass through. This procedure ensures that the amount of seed entering the return is minimized, thereby minimizing seed breakage.

Usually buckwheat yields 800-1000 kg/ha, although yields of 2000 kg/ha and higher have been produced under favorable conditions in Manitoba.

## Storage

A moisture content of 16% or less is necessary for safe storage of buckwheat. If the seed requires drying, the temperature should not exceed 43°C. This temperature limit applies to seed for both seeding and commercial use. Do not store grain for sale the next year, because the Japanese market demands buckwheat from new crops only. Mixing seed from old and new crops reduces marketability. Mixtures of old and new seed can be easily detected because the light green color of the layer just under the hull in freshly harvested seed gradually changes to reddish brown during storage.

## Marketing

Buckwheat is marketed according to grades established under the Canada Grain Act, as shown in Table 1. Most of the buckwheat crop is exported and the rest is used domestically. The export market has recently undergone many changes, with Japan now providing the largest market for Canadian buckwheat. Future prospects look good for the buckwheat grower. However, for an assured market and a guaranteed price, be sure to obtain a sales contract in advance.

## Uses

Buckwheat is most commonly grown as a grain for human consumption. It has also been grown as a livestock and poultry feed, a green manure crop, a companion crop, a smother crop, and as a source of dark buckwheat honey. Although the grain and straw can be used for livestock feed, the total nutritive value is lower than that of cereals.

Consumption of buckwheat in Canada accounts for about one-third of the crop. It is used in pancake mixes, breakfast cereals, poultry dressing, and certain breads and ethnic dishes.

In Japan, buckwheat flour is mixed with wheat flour in the manufacture of buckwheat noodles. The buckwheat flour must be milled from fresh seed to have the desired flavor. Therefore, the Japanese market does not accept mixtures of buckwheat seed from old and new crops. The Japanese use the hulls from the seeds for stuffing pillows.

The protein in buckwheat flour is of exceptionally high quality because it contains a considerable amount of lysine, a protein component deficient in cereal products. Buckwheat is rated as one of the best sources of high biological value protein in the plant kingdom.



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5

1. Pin flower with taller female and shorter male parts.
2. Thrum flower with shorter female and taller male parts.
3. Flower cluster showing stages of maturity.
4. Flowering is almost finished and 75% of the seeds have turned brown.
5. Dehulled seed: (a) buckwheat from a new crop is light green, (b) buckwheat from an old crop is reddish brown.



Table 1. Buckwheat - primary grade determinants

\* K refers to kernel size pieces in 500 grams. The type shall be designated by size, large or small, determined by sizing using a No. 4 slotted sieve, and shall be added to and become part of the grade name.



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